

SPACE SYSTEMS SYMPOSIUM (D1)
Space Systems Architectures (4)

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OPTIMISING FRACTIONATED ARCHITECTURES

Abstract

The concept of fractionated satellites has been explored for the last six years, with DARPA's System F6 program the most prominent of the research efforts. Research in this area has been focused largely on the programmatic and economic benefits of fractionation. However, there are also significant technical and operational challenges to fractionation that have not been studied as extensively. Consequently this paper looks at fractionated satellites from this underexplored point of view. In this work, a variety of fractionated architectures have been simulated taking into account the satellite and subsystem failures based upon different failure rate assumptions. The architectures are characterised by a few simple parameters, such as the extent of the fractionation of the system, the number of satellites in the formation, and the location of subsystems within the formation. Operational replacement and redundancy strategies for failed satellites have also been studied. The architectures are simulated for a period of time that far exceeds the lifetime of a conventional, monolithic spacecraft, to investigate the effects and operational implications of maintaining the fractionated system in orbit for a long period of time. The outputs of these simulations are used to highlight particular fractionated architectures and operational concepts that will enable space systems to maintain a high level of operational time on orbit. Results show that this will be strongly influenced by the redundancy strategy employed, the failure rate used and the degree of fractionation of the system.